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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the pneumatic form cushion tire both for [ which made oblateness small ] an industrial vehicle.

[0002]

[Description of the Prior Art] Conventionally, in order to raise \*\*\*\*\* with a rim, the pneumatic form cushion tire of the two-layer formula which carried out the laminating of the high base rubber layer of compressibility and the tread rubber layer which was excellent in abrasion resistance and injury-proof nature at the ground-plane side, and the pneumatic form cushion tire of the three-layer formula which prepared the middle rubber layer which is rich in cushioning properties by low febrility between the base rubber layer and the tread rubber layer are known.

[0003]

[Problem(s) to be Solved by the Invention] However, in such a conventional thing, there was much amount of the rubber used, in order to reduce the amount of the rubber used, when oblateness was made small, impact-absorption nature fell and there was a problem that the riding comfortability of a fork lift truck became extremely bad. Moreover, when impact-absorption nature fell, run stability also became bad, it may have led to fall of a load and the endurance of a tire rim or the fork lift truck itself may also have been affected.

[0004] The technical problem of this invention is to offer the pneumatic form cushion tire which made oblateness small, preventing the fall of impact-absorption nature.

[0005]

[Means for Solving the Problem] That this technical problem should be attained, this invention took the following means in order to solve a technical problem. Namely, have a tread rubber layer and a base rubber layer, and it sets into the pneumatic form cushion tire which has arranged the bead core symmetrically to a tire equatorial plane in a base rubber layer. Oblateness is made into 40 - 95%. a vertical spring constant 60 to 150 kgf/mm, It is JIS of 10 - 50% of tire height, and a base rubber layer about the height of 40 - 75%, and a base rubber layer in the impact resilience of tread rubber. The pneumatic form cushion tire characterized by making A degree of hardness into 65 - 95 degrees is it.

[0006] Moreover, it is good also considering tread RAJIASU as 100-600mm, or is JIS of a tread rubber layer. It is good also considering A degree of hardness as 50 - 70 degrees.

[0007]

[Embodiments of the Invention] The gestalt of operation of this invention is explained in detail based on a drawing below. as shown in drawing 1, 1 is a pneumatic form cushion tire and rims 2 and 3 are equipped with the pneumatic form cushion tire 1 -- having -- and a cross-section configuration -- a pneumatic tire and abbreviation -- it is a tire both for [ which was made into the same configuration ] an industrial vehicle

[0008] The pneumatic form cushion tire 1 is equipped with the base rubber layer 4 with which rims 2 and 3 are equipped, and the tread rubber layer 6 formed in the ground-plane side. In addition, you may make it prepare the middle rubber layer which is rich in cushioning properties between the base rubber layer 4 and the tread rubber layer 6. A middle rubber layer raises cushioning properties, prevention of generation of heat, the partial wear-proof nature of a tread, etc. Moreover, not only one layer but more than two-layer is sufficient as a middle rubber layer if needed.

[0009] The oblateness (= tire height H / width-of-tire W) of the pneumatic form cushion tire 1 is 40 - 95%. If oblateness becomes 40% or less, thickness becomes thin too much, and the riding comfortability under run gets worse [ to a degree ] very much and is not desirable. If 95% is exceeded, the curtailment effect of the amount of the rubber used will become small, improvement of rolling resistance and the improvement effect of run stability also become small, and it is not desirable. In addition, it is 50 - 85% especially preferably.

[0010] The deformation amount (at the time of normal load the load of 1.0t) of the whole pneumatic form cushion tire 1 is 10 - 40% of tire height H. If the oscillating absorptivity under run will fall if less than 10%, riding comfortability falls and 40% is exceeded, the rigidity as a tire falls too much and is not desirable. A fall of a deformation amount also reduces oscillating absorptivity.

[0011] The vertical spring constant of the pneumatic form cushion tire 1 is 60 to 150 kgf/mm. Since the rigidity as a tire will fall too much and rolling resistance will also fall further preferably if a vertical spring constant is less than 60 kgf(s)/mm, it is not

desirable. If 150 kgf(s)/mm is exceeded on the contrary, rigidity is too high, and since the oscillating absorptivity under run falls and riding comfortability falls, it is not desirable.

[0012] As horizontal rigidity (resistance force when displacing 40mm horizontally with the normal load of 1.0t) of the pneumatic form cushion tire 1, they are 400kgf(s). The above is required. Horizontal rigidity is 400kgf(s). If it becomes below, the resistance force to the revolution under run etc. becomes small too much, and stability falls and is not desirable. Moreover, 700kgf Since impact-absorption nature will fall and riding comfortability will become bad if it becomes above, it is not desirable.

[0013] Height BH of the base rubber layer 4 is 10 - 50% of height H of the pneumatic form cushion tire 1. Since rigidity will fall, a deformation amount will become large too much and horizontal rigidity will also become small too much if height BH of the base rubber layer 4 is less than 10%, it is not desirable. Moreover, since the base rubber layer 4 which prevents a rim slip decreased too much, when rubber deteriorates in long-term use, idling may be caused and it is not desirable. Since rigidity becomes large too much, a deformation amount becomes small as a result, oscillating absorptivity will fall and riding comfortability will become bad if 50% is exceeded, it is not desirable. Moreover, since the thickness of the tread rubber layer 6 becomes small too much and supports various loads with thin thickness, it becomes easy to deteriorate by generation of heat, the mechanical fatigue, etc. and is not desirable.

[0014] JIS of the base rubber layer 4 A degree of hardness is 65 - 95 degrees. JIS of the base rubber layer 4 Since rigidity will fall, a deformation amount will become large too much, horizontal rigidity will also become small too much and it will become easy to generate rim gap etc. if A degree of hardness is less than 65 degrees, it is not desirable. Moreover, since it falls and becomes easy to race a rim-proof slip performance, it is not desirable. If 95 degrees is exceeded, it is too hard, and since the attachment nature at the time of a rim group becomes bad, it is not desirable.

[0015] In addition, as for the modulus of elasticity in tension at the time of 100% extension by the JIS No. 3 type dumbbell, being referred to as 2-10MPa is desirable, as for tensile strength, similarly being referred to as 7-30MPa is desirable, as for elongation, similarly considering as 200 - 500% is desirable, and it is desirable for the compression set by the degradation conditions of 100 degree-Cx 22 hours to consider as 30 - 70% (above JIS K6301 - 1975). A proper base rubber layer can be formed by the above.

[0016] In the base rubber layer 4, the bead core 8 is formed and the bead core 8 is symmetrically formed to the tire equatorial plane L. The thing called bunch-like strand bead wires which come to return two or more bead wires, or one thick steel ring is sufficient as the bead core 8. In the case of strand bead wires, it is brass plating, and, in the case of a steel ring etc., it is good to apply various adhesives and to aim at adhesion with base rubber.

[0017] The pulse duty factor (number  $\times$  CW/BW $\times$ 100 of = bead core 8) of the bead core width of face CW to the bead width of face BW in which the bead core 8 contains the bead core 8 is 5 - 30%. Since the attachment nature at the time of a rim group will become bad if it becomes 30% or more preferably, since it will fall and become easy to race a rim-proof slip performance if a pulse duty factor is less than 5%, it is not desirable.

[0018] The ratio [ as opposed to / position / of the shaft orientations of the bead core 8 ] the bead width of face BW in the inside bead core 8 / (=BC1/BW) of the position BC1 of the bead core 8 is less than 50%, and the ratio / as opposed to the bead width of face BW in the outside bead core 8 / (=BC2/BW) of the position BC2 of the bead core 8 is 55 - 90%.

[0019] If the position of the inside bead core 8 exceeds 50%, a tire center section fastens, and \*\* (the hoop of a bead core effect) falls, becomes easy to race and is not desirable. If less than 55% about an outside, a tire outside fastens, and \*\* falls, becomes easy to race and is not desirable. Since there will be no margin of deformation by rubber in case the bead core 8 is outside too much and a rim is inserted at the time of a rim group and rim attachment nature will become bad if 90% is exceeded, when it was outside too much further and a rim gap arises, the bead core 8 is easy to expose and is not desirable preferably.

[0020] The bore CD of the bead core 8 is 102 - 107% of the diameter RD 2 of a rim. It becomes [ the rubber of the lower part of the bead core 8 has a possibility that a crack may enter if 107% is exceeded preferably, will fasten, and \*\* falls, and ] easy to race and is not desirable, when the load exceeding a limitation is added, since the attachment nature at the time of a rim group becomes bad and the bead core 8 approached the rim too much, when less than 102%.

[0021] The compressibility (rate of the rubber thick decrement after rim \*\*\*\* to rubber \*\* in front of rim \*\*\*\*) of the rubber under the bead core 8 at the time of a rim group is 10 - 40%. Since the attachment nature at the time of a rim group will become bad if 40% is exceeded preferably, since it will fall and become easy to race a rim-proof slip performance if compressibility is less than 10%, it is not desirable.

[0022] The number of the bead core 8 is plural (2-8 [ for example, ]). a hoop with the bead core of the idling prevention by the number of the bead core 8 being one -- the portion which demonstrates an effect -- concentrating -- passing -- racing -- being easy -- and the various stress under run around the bead core 8 -- concentrating -- being easy -- the separation of the bead core 8 and the base rubber layer 4 -- generating -- being easy -- since it leads also to the defluxion which is the bead core 8, it is not desirable. Since the bolting pressure to rims 2 and 3 becomes high too much, and a superfluous burden will start, it will become the cause of deformation and the crack of rims 2 and 3 (especially the screw thread of rims 2 and 3 a hole crack generated on the outskirts) and the attachment nature at the time of a rim group will also become bad simultaneously if eight are exceeded, since it also becomes superfluous quality, it is not still more desirable preferably.

[0023] the total intensity (the total tensile strength of the total of the bead core 8) of the bead core 8 -- 3000-30000kgf it is . The total intensity is 3000kgf(s). When less, misgiving is in endurance, and it is 30000kgf. Since it will become superfluous quality if it exceeds, it is not desirable. The interference (= (BW-LW)/LW $\times$ 100) of the bead width of face BW of the base rubber layer 4 to the rim width of face LW is 3 - 15%. Preferably, since the attachment nature at the time of a rim group will become bad if 15% is exceeded, it is not [ that it will be easy to race if an interference is less than 3% ] desirable.

[0024] The interference [ as opposed to the rim bore RD 1 on the tire equatorial plane of rims 2 and 3 to the time of rim \*\*\*\* ] (=  $(RD1-BD1) / RD \times 100$ ) of the bead minor diameter BD 1 of the pneumatic form cushion tire 1 is 0 - 8%. Preferably, since the attachment nature at the time of a rim group will become bad if 8% is exceeded, it is not [ that it will be easy to race if an interference is less than 0% ] desirable.

[0025] The interference (=  $(RD2-BD2) / RD \times 100$ ) of the bead major diameter BD 2 of the pneumatic form cushion tire 1 to the diameter RD 2 of a rim equivalent to the tire outside of rims 2 and 3 is -1 - 6%. Preferably, since the attachment nature at the time of a rim group will become bad if 6% is exceeded, it is not [ that it will be easy to race if an interference is less than -1% ] desirable.

[0026] When attaching to a rim with a rim flat side, you may establish the bead flat side 10 in the inner skin of the base rubber layer 4. It is made for the width of face of the tire shaft orientations of the bead flat side 10 to become 0 - 150% to the width of face of tire shaft orientations the same [ a rim flat side ]. Since configuration nonconformance with a rim flat side will become large and the attachment nature at the time of a rim group will become bad if 150% is exceeded, it is not desirable.

[0027] The block-copolymer structure of the base rubber layer 4 where natural rubber and the amount of combined styrenes were manufactured as a part for gum according to the solution polymerization which is 40 - 50 % of the weight is the styrene butadiene rubber of a subject. Phenol resin is further contained with the carbon black which made HAF class the subject as a reinforcing agent, and a hexamethylenetetramine is contained as a curing agent of phenol resin. Moreover, the compounding agent generally used in addition to this is contained.

[0028] The tread rubber layer 6 may make a subject diene system rubber, such as natural rubber, a styrene butadiene rubber, and butadiene rubber, and may add a silica further with carbon black to a reinforcing agent. In silica use, you may use a coupling agent. In addition, the compounding agent generally used is contained. Moreover, in the case of the color tire which does not use carbon black, a silica may be made into main reinforcing agents for diene system rubber, such as natural rubber, a styrene butadiene rubber, and butadiene rubber, at a subject, and it may use a coupling agent together further. Moreover, you may add titanium oxide etc. as a pigment. Moreover, the compounding agent generally used in addition to this is contained.

[0029] The impact resilience of the tread rubber layer 6 is 40 - 75%. Impact resilience is the specification of BS (BURITESSHU standard) NO.903, and has an Oriental energy machine factory resilience circuit tester etc. as a testing machine. A resilience circuit tester makes the sphere attached at the nose of cam of a pendulum collide with a test piece, reads the angle of the rebound phenomenon, and expresses input energy and return energy with percentage. Since rolling resistance will become large too much if impact resilience is less than 40%, oscillating absorptivity will fall and riding comfortability will become bad shortly preferably if 75% is exceeded, it is not desirable. Oscillating absorptivity improves and riding comfortability becomes good, so that impact resilience is small.

[0030] JIS of the tread rubber layer 6 A degree of hardness is 50 - 70 degrees. JIS of the tread rubber layer 6 Since rigidity will fall, a deformation amount will become large too much and horizontal rigidity will also become small too much if A degree of hardness is less than 50 degrees, it is not desirable. Since rigidity will become large too much, a deformation amount will become small as a result, horizontal rigidity also becomes large too much, oscillating absorptivity will fall and riding comfortability will become bad if 70 degrees is exceeded, it is not desirable.

[0031] In addition, as for the modulus of elasticity in tension at the time of 100% extension by the JIS No. 3 type dumbbell, being referred to as 2-10MPa is desirable, as for tensile strength, similarly being referred to as 10-30MPa is desirable, and, similarly it is desirable to make elongation into 300 - 700% (it applies to JIS K6301-1975 correspondingly above). A proper tread rubber layer can be formed by the above.

[0032] Tread RAJIASU is 100-600mm. It becomes [ a tread side turns into a convex too much, a crawler bearing area becomes small too much, and / wear ] early and is not desirable if tread RAJIASU becomes smaller than 100mm. Since it will become a flat too much and steering nature will fall if it becomes larger than 600mm, it is not desirable.

[0033] In addition, what formed the side carcasses 14 and 16 can carry out the pneumatic form cushion tire 1 similarly like the pneumatic form cushion tire 12 shown not only in what was mentioned above but in drawing 2. The same number is attached about the same thing as the member mentioned above all over drawing, and detailed explanation is omitted.

[0034] With this pneumatic form cushion tire 12, bead wires 18 and 20 are formed in the side carcass 14 and 16. About the base rubber layer 4 and the tread rubber layer 6, it is the same as that of the operation gestalt mentioned above. Above, this invention is not limited to such an operation gestalt at all, and can be carried out in the mode which becomes various in the range which does not deviate from the summary of this invention.

[0035]

[Effect of the Invention] As explained in full detail above, since the pneumatic form cushion tire of this invention can cut down the amount of rubber to be used sharply, and can attain saving-resources-ization and can also shorten a manufacturing process sharply, it leads to man day curtailment, and has a great merit economically. Moreover, in spite of carrying out flattening, there is no inferiority in riding comfortability and a burden is not applied to an operator, but it can be adapted also for various operation conditions satisfactory. Also on a tire performance target, since rubber \*\* is thin, rolling resistance is small, energy expenditure decreases, and it is desirable. Also about generation of heat inside the tire under run, similarly, since rubber \*\* is thin, it becomes low, and the heat deterioration of rubber is hard to go on and is desirable. Also about run feeling, oblateness becomes small and there is sense of stability.

[Translation done.]